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5 PATENT
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7 MODULAR AND STACKABLE TRAY ASSEMBLY
8

9 BACKGROUND OF THE INVENTION

10 FIELD OF THE INVENTION

11 The present invention relates to an assembly of individual trays of different heights which
12 can be releasably locked together and carried as a single unit.

13 DESCRIPTION OF THE PRIOR ART

14 Boxes, and particularly compartmentalized boxes, for storing craft, fishing hardware and
15 other small items (e.g., beads, lures, screw, etc.) are generally configured as single units with lids.
16 Each unit is generally carried separately or stacked in an unsecured arrangement. Picking up and
17 transporting a pile of such boxes can easily cause an unexpected separation of the piled boxes
18 spilling the contents thereof.

19 Stackable storage containers which can be releasably locked together are known as
20 illustrated, for example, in U.S. Patent Nos. 3,339,725 ("'725 patent"); 4,619,363 ("'363 patent");
21 and 6,273,258 ("'258 patent").

22 The '725 patent employs a flat sheet (1) of cardboard or the like with the central section
23 extending over the top container and the end sections extending along the sides of the single or
24 stacked container(s) and secured to the beaded rim(s) surrounding the openings(s) of the lower
25 container(s). The sheet (1), which holds the containers together, constitutes an extra component and
26 does not provide a particularly reliable/reusable locking system.

27 The '363 patent discloses a storage unit in which two trays of different heights and apparently
28 vertically aligned side walls may be stacked and carried as a unit. A separate connecting element
29 (13) is releasably secured between the sides of each pair of stacked trays. While the connecting
30 elements would apparently provide a secure locking arrangement between the several trays, they

1 would be cumbersome to use. The patent refers to the possible use of a hinged connecting element,
2 as an alternative. However, no specifics are given as to its construction.

3 The '258 patent discloses a stackable container system for storing foodstuffs in which
4 identical containers are secured together by flexible flaps (18). Such a flexible flap arrangement is
5 not particularly robust. Also, absent the presence of the lid 22, there is no convenient handle with
6 which to carry the stacked containers.

7 There is a need for a economical and stackable tray assembly with a robust locking
8 mechanism, particularly for a stackable tray system in which the trays have different heights with
9 optional dividers to form individual compartments within the trays. For economic reasons trays
10 and other containers for storing small items are often injection molded of a plastic material such as
11 polypropylene, polyethylene or copolymers. A split two-part mold can be employed to form straight
12 peripheral or side walls in such trays. While the use of a single non-split mold will result in a
13 simpler and less expensive molding process, the peripheral walls must be outwardly inclined (i.e.,
14 draft angle) in order to remove the molded tray from the mold. The releasable locking arrangement
15 of my invention accommodates stacked trays of different heights and the use of a single mold for
16 each tray height.

17 **SUMMARY OF THE INVENTION**

18 A system for open top trays of variable heights arranged to be stacked together in any
19 arrangement, in accordance with the present invention, comprises a group of trays with each tray
20 having a bottom and longitudinal and perimeter walls which terminate in an upper edge or rim
21 defining an opening through which articles may be placed in and removed from the tray. Preferably
22 a plurality of dividers are mounted in the tray to form individual compartments. The peripheral walls
23 have an inwardly stepped or undercut section joined to the bottom which undercut section nests on
24 the rim of the lower tray in a complementary manner to substantially align the peripheral walls of
25 the nested trays with the rim of each tray having the same dimensions regardless of the tray height.
26 The trays in a stacked position define a common interface datum plane coincident with the rim of
27 the lower tray. A latch handle is rotatably mounted on the exterior of each transverse perimeter wall
28 about a rotational axis located at a distance d_1 below the datum plane and a latch hook protrudes
29 outwardly from each transverse wall at a distance d_2 above the datum plane. The latch handle

1 includes a locking tab arranged to engage the latch hook of an above positioned tray (or lid) when
2 the latch handle is rotated to a closed position.

3 Preferably each latch handle is rotatably mounted on an axle molded integrally with the
4 transverse walls and spaced outwardly from a recessed central section thereof. Alternatively the
5 latch handles may be provided stub axles positioned in an axle receiving openings in the transverse
6 walls adjacent a recessed central section thereof.

7 Preferably the rotational axis of the latch handles and the latch hooks are separated by
8 distances d_3 and d_4 , respectively, regardless of the height of the tray. The underside of the latch
9 handle (in the locked position) has a generally semicylindrical shape to provide a user friendly handle
10 portion for lifting and transporting stacked trays. Preferably the trays are provided with integrally
11 molded or removable dividers to form compartments within the individual trays.

12 In addition the assembly includes a lid with a top wall, longitudinal and transverse side walls
13 with a latch hook extending outwardly from each transverse wall and above the datum plane by the
14 distance d_2 for engagement by the locking tab of an associated latch handle on the underlying tray.
15 The lid further includes a pivotal handle in the center section of the lid top wall to accommodate the
16 hand of a user desiring to lift and transport the stacked assembly.

17 The modular and stackable tray assembly of the present invention may best be understood
18 in reference to the following description taken in conjunction with the appended drawings.

19 BRIEF DESCRIPTION OF THE DRAWINGS

20 Fig. 1 is a perspective view of a stackable tray assembly including a cover or lid in the
21 stacked and locked position in accordance with the present invention.

22 Fig. 2 is a side elevational view of the assembled trays of Fig. 1.

23 Fig. 3 is a front elevational view of the assembled trays of Fig. 1.

24 Fig. 4 is an exploded disassembled perspective view of the trays of Fig. 1.

25 Figs. 5 and 6 are perspective views of the lower and assembled lower and intermediate trays
26 shown in Fig. 1, respectively.

27 Fig. 7 is a cross sectional view, partially broken away, taken along lines 7-7, of Fig. 2,
28 showing the releasable locking arrangement for the individual trays with the dividers illustrated in
29 Fig. 4 not shown for clarity.

1 Fig. 8 is an enlarged view of the releasable locking arrangement between two of the trays of
2 Fig. 7 illustrating various dimensions.

3 Fig. 9 is an enlarged view of the releasable locking arrangement between the cover or lid and
4 one of the trays of Fig. 7 illustrating various dimensions.

5 Figs. 10 and 11 are perspective views of the front and rear sides of the latch handle,
6 respectively.

7 Figs. 12 and 13 are top and bottom plan views of the cover or lid, respectively.

8 Fig. 14 is a perspective view of the handle for the cover.

9 Fig. 15 is a perspective view of an alternative latch handle.

10 Fig. 16 is a partial perspective view of a transverse peripheral wall of a tray showing an
11 opening therein for receiving the stub axles of the alternative latch handle.

12 DESCRIPTION OF THE PREFERRED EMBODIMENT

13 Referring now to Figs. 1-5 a tray system or assembly designated generally at 10 of the present
14 invention includes a plurality of open top trays with a bottom tray 12, an intermediate tray 14, an
15 uppermost tray 16 and a cover or lid 18.

16 The trays are injection molded, preferably with a one piece mold, of a suitable rigid
17 thermoplastic material such as polypropylene, polyethylene or a copolymer. Preferably, the trays,
18 i.e., at least two, have different heights, h. As an example, a set of four trays may have heights of
19 4", 3", 2" and 1 1/4" and have suitable lengths and widths such as 16" and 8", respectively. It is to
20 be understood that the specific dimensions given are by way of example only.

21 As is illustrated more particularly in Figs. 5 and 7, each tray includes a bottom wall 20,
22 longitudinal peripheral walls 22, and transverse peripheral walls 24 (collectively "peripheral walls")
23 with the peripheral walls being inclined outwardly to the vertical (at an angle designated as θ in Fig.
24 3) to accommodate removal from the mold. The peripheral walls terminate in an upper edge or rim
25 through which articles may be placed in and removed from the open trays. The angle θ of the
26 inclination may be in the range of .5° to 2° with the angle dependent upon the height h of the tray
27 so that the rim of the trays have substantially the same dimensions for nesting purposes as will be
28 explained. The peripheral walls are joined to the bottom via an inwardly stepped or undercut section
29 23 (Fig. 7) which mates with the rim of the lower tray to align the peripheral walls and maintain the

1 trays in a nested arrangement. As is illustrated in Fig. 8 a horizontally oriented shelf 23a of the
2 undercut section rests on the rim 25 of the lower tray.

3 The longitudinal and transverse peripheral walls are joined at a radiused corner sections 26
4 (Fig. 5) with the center sections 22a of the longitudinal walls recessed slightly, as illustrated, for
5 decorative purposes. A central section 24a of the transverse walls is also recessed with axle 28
6 integrally molded into the side sections 24b and spaced outwardly from the central section (Fig. 1)
7 to accommodate an axle receiving groove 30a in a latch handle 30 (Fig. 14) rotatably mounted on
8 the axle as will be explained in more detail (the side sections 24b extending perpendicularly
9 outwardly from the central section 24a). The center of the axle is supported via a stub support
10 member 28a which extends outwardly from the recessed center portion 24a. See Fig. 8. The
11 peripheral walls include circumscribing outwardly protruding ribs 31, adjacent the rim, for
12 decorative purposes. See Fig. 5.

13 A protruding latch hook member 32 (extending upwardly from two spaced horizontal ribs
14 32a) is also integrally molded in the bottom of the center section 24a of each transverse peripheral
15 wall for receiving a locking tab 30b on the latch handle when in its closed position to lock the several
16 trays together. See Figs. 1, 8 and 9. The latch handle is formed with a tab 30c which may be rotated
17 by a user's finger to engage or disengage the locking tab from the latch hook 32 to lock or unlock
18 the trays. The underside 30d of the bottom of the latch handle is semicircular in shape and serves
19 as a handle for lifting one or a stack of trays. The center section of the bottom of the latch handle
20 is notched at 30e to accommodate the stub support member 28a. See Figs. 10 and 11.

21 As discussed earlier the trays, in a stacked position, with the undercut shelf 23a of the upper
22 shelf resting on the rim 25 of the lower shelf, define a datum plane coincident with the lower tray
23 rim as is illustrated in Fig. 8.

24 The axle 28 is spaced below the datum plane by a distance d_1 with the latch hook 32 spaced
25 above the datum plane by a distance d_2 in each tray regardless of the tray height. The distance
26 between the center of the latch handle groove 30a and the locking tab equals $d_1 + d_2$. Preferably the
27 distances d_3 and d_4 between the axles 28 and latch hooks 32, respectively, on each tray, regardless
28 of tray height, are the same so that the axles and latch hooks will be aligned vertically (although in
29 different planes as illustrated) with the trays in a stacked position as is illustrated in Fig. 7.

1 Referring now to Figs. 1, 12 and 13 the cover or lid 18 includes longitudinal and transverse
2 perimeter walls 18a and 18b, respectively, with a center section 18c of each transverse wall being
3 recessed for alignment with the recessed center sections 24a of the trays in the stacked position. The
4 sections 18c are molded with protruding latch hooks 32', aligned with the latch hooks 32, of the
5 lower stacked trays. As is illustrated in Fig. 9 the locking tab 30b of the lower tray latch handle
6 engages the latch hook 32' to lock the cover to the underlying tray(s). As is illustrated in Fig. 9, the
7 distances d_5 and d_6 represent the distances between the axles 28 and latch hooks 30b, respectively,
8 from the recessed wall sections 28a.

9 The lower end of the cover perimeter sections are formed with an overcut section 18d
10 defining a horizontally extending shelf 18e and an overhanging vertically oriented skirt 18f. The
11 shelf 18e rests on the rim of the underlying tray and defines the datum plane for determining the
12 distance d_2 as is best illustrated in Fig. 9. The skirt 18f fits over the outside of the rim and upper
13 portion of the perimeter walls of the lower tray.

14 The upper side of the cover includes a depressed center section 18g, merged between side
15 sections 18h via vertically oriented stub walls 18i. The stub walls have openings 18j for receiving
16 stub axles 36a of a handle 36. See Figs. 1 and 14. The longitudinal and peripheral sections of the
17 cover include decorative curved sections 18k merged with the overcut section 18d.

18 As is best illustrated in Fig. 13 the underside of the center section of the cover is designated
19 18g. Strengthening ribs 18l are also included on the underside of the cover.

20 Referring now to Figs. 4 and 5 divider receiving guides 38 are integrally molded to the
21 interior surfaces of the longitudinal perimeter walls of trays 12 and 14 with removable dividers 40
22 mounted in some of the guides. Each guide is formed by a pair of elongated opposed generally
23 semicylindrical sections 38a defining a narrow slot therebetween for receiving and releasably
24 retaining a divider 40. Preferably the removable dividers are formed with semicylindrical end
25 sections 40a which are complementary with the elongated cavities formed by the sections 38a. See
26 Fig. 5.

27 One or more dividers 42 may be integrally molded with the trays as illustrated in tray 16 of
28 Fig. 4. In addition vertically oriented spool receiving posts 42 may be integrally molded in a section
29 of a tray. Alternatively, the posts 42 may be molded to a removable plate (not shown) for placement

1 in a section of the tray as in Fig. 4.

2 The dividers may have a height, such as is illustrated in the tray 14, so that the bottom of a
3 overlying tray will be positioned closely above the dividers to inhibit any articles from spilling from
4 one compartment to another in the event that the locked assembly is tipped upside down.

5 As an alternative to the latch handle and fixed axle arrangement shown in Figs 1 and 9-11,
6 the latch handle (designated 40) may be in the form shown in Fig 15 and 16 with stub axles
7 extending into openings 42 in the transverse wall side sections 24b'. With either arrangement the
8 latch handle rotates about an axis of rotation located at distance d_1 below the datum plane.

9 While the trays and cover may be molded of any suitable plastic, they are preferably made
10 of polypropylene. I have found that the nominal wall thickness t of .080" for the trays is suitable
11 while a somewhat greater thickness may be preferable for the skirt sections of the top since the top
12 must carry the weight of the stacked assembly when the handle 36 is used to transport the underlying
13 trays. It is to be noted that the semicylindrical latch handle portions 30d may be used to carry the
14 assembled trays with or without the cover in place.

15 There has thus been described a novel modular and stackable tray assembly with the
16 individual tray arranged to accommodate removable or stationary dividers to form compartments and
17 a reliable locking system to allow a stacked tray assembly to be conveniently carried with or without
18 a cover. Various modifications to the invention will become apparent to those skilled in the art
19 without involving any departure from the spirit and scope of the present invention as defined in the
20 appended claims.